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13. SUPPLEMENTARY NOTES**14. ABSTRACT:**

The goal of this study was to begin the development of a computer-based software tool to automate the survey and reporting functions for ergonomic assessments. Ten Department of Defense installations participated in the beta test. The program was tested for user acceptability in the areas of system design, checklist design and content, report design and content, and proficiency. The beta test showed that the tool developed is a good first step in the development of an ergonomic checklist tool. The beta test users responded that the tool met many of the requirements needed for an ergonomic survey checklist, and that with a little practice and effort the majority of users can become proficient with the system. This proficiency will allow users to maximize their time spent in ergonomic efforts. The beta test also showed that the tool needs further development relative to the reporting function before further implementation can proceed.

15. SUBJECT TERMS

Ergonomics Assessment, Computer based assessment tool, Personal Digital Assistant, Beta test

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ABSTRACT

Accurate and timely ergonomic assessments leading to the redesign of the workplace, tasks, tools and equipment are essential to facilitate the return to full-time duty for civilian and military personnel following an injury. The assessments also prevent the development of long-term disabilities and protect other personnel from future work-related musculoskeletal disorders (WMSDs). The shortage of trained professional ergonomists who can conduct these assessments has resulted in poorly focused efforts relative to return to duty, frequent re-injuries, eventual increases in hospitalizations and disabilities, unnecessary pain and discomfort, decreased productivity, and decreased overall unit support and readiness. The development of a computer-based ergonomic assessment tool will allow installation safety and health personnel to conduct more efficient ergonomic surveys and prepare more comprehensive reports.

A beta test of the system was conducted to test the system's design and user characteristics. The beta test also provided valuable information from field users that will be incorporated into the final version of the software before implementation. The goal of this study was to begin the development of a computer-based software tool to automate the survey and reporting functions for ergonomic assessments.

Ten Department of Defense installations participated in the beta test. The program was tested for user acceptability in the areas of system design, checklist design and content, report design and content, and proficiency.

The beta test showed that the tool developed is a good first step in the development of an ergonomic checklist tool. The beta test users responded that the tool met many of the requirements needed for an ergonomic survey checklist, and that with a little practice and effort the majority of users can become proficient with the system. This proficiency will allow users to maximize their time spent in ergonomic efforts. The beta test also showed that the tool needs further development relative to the reporting function before further implementation can proceed.

BODY

1.0 Introduction:

The goal of this study was to begin the development of a computer-based software tool to automate the survey and reporting functions for ergonomic assessments. The implementation of this tool will allow installation safety and occupational health personnel to conduct efficient ergonomic surveys and prepare comprehensive reports. A beta test of the system was conducted to test the system's design. The beta test also provided valuable information from field users that will be incorporated into the final version of the software prior to implementation.

2.0 Background:

Accurate and timely ergonomic assessments leading to the redesign of the workplace, tasks, tools and equipment are essential to facilitate the return to full-time duty for civilian and military personnel following an injury. The assessments also prevent the development of long-term disabilities and protect other personnel from future WMSDs. The shortage of trained professional ergonomists who can conduct these assessments has resulted in poorly focused efforts relative to return to duty, frequent re-injuries, eventual increases in hospitalizations and disabilities, unnecessary pain and discomfort, decreased productivity, and decreased overall unit support and readiness.

Currently, evaluators follow several steps to conduct an ergonomic assessment: (1) The evaluator identifies or develops assessment questions that are appropriate for the work area being assessed. (2) The evaluator performs the assessment using the manual pen and paper data collection method. (3) The evaluator compiles and analyzes the survey data and produces a report for each of the surveys conducted. If the evaluator wants to track trends, a separate computer program must be developed to accomplish this task. The Web-based Ergonomic Assessment Computer Tool (WE@CT) was developed to automate most of the assessment process by standardizing the assessment questions by type of work area and specific area of concern or specific type of exposure; streamlining the data collection process; storing the data in a data base; and generating a report of findings and recommendations.

3.0 WE@CT Product Development:

The WE@CT consists of a mobile data collection and Web-based application for data entry, manipulation, analysis, and reporting. The mobile data collection component is developed in Microsoft Windows® Visual Studio .NET® and submits data to a central Microsoft SQL Server 2000® data base. The Web-based component is comprised of Microsoft Windows® Active Server Pages (ASPs) and is capable of interfacing with the central data base. See Appendix A for Technical Summary.

Use of trademarked names does not imply endorsement by the U.S. Army but is intended only to assist in identification of a specific product.
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3.1 User Interface Description:

There are two distinct user interfaces in the WE@CT application, a mobile interface and a Web interface. The mobile interface functions similar to a Microsoft® Windows® application, but serves strictly as a checklist-driven data collection and submission tool for ergonomic surveys via a Personal Digital Assistant (PDA).

The WE@CT program is divided into 10 specific checklists (General Ergonomics, General Office, Chair, Material Handling, Hand Tool, Video Display Terminal (VDT) Assessment, Washington State-Caution Zone, Washington State-Hazard Zone, Level 1-Administrative Task Analysis, Level 1-Industrial Task Analysis). The 10 checklists used represent the most popular paper-based ergonomic survey tools currently used by the Army and other Department of Defense (DOD) agencies based on discussions with members of the DOD Ergonomic Working Group.

Each checklist is divided into deficiency statements that prompt the user to evaluate a specific area of ergonomic concern. Each of these deficiency statements is linked to a specific recommendation for remediation. For example, in the hand tools checklist, the user is asked if “The use of the tool places the wrist in an awkward posture.” If this statement is true, the user selects this statement, and a recommendation is generated to address the concern. The WE@CT program keeps a running list of all deficiencies and recommendations made for the evaluation currently being conducted.

A user may accept the recommendation generated, or edit the recommendation, or make a more specific and appropriate recommendation by entering it manually on the mobile device. The WE@CT stores this information which is then uploaded into a report. An example of a deficiency statement and recommendation is shown in Appendix B.

Once a survey is complete, the user places the PDA into its cradle and sends the data to the WE@CT Web site via a user ID and password that is entered on the PDA (Appendix B). By entering the user ID and password into the WE@CT program on the PDA, the data is sent to the WE@CT Web site and stored in an online data base. The user can then edit the findings and recommendations online.

3.2 Web Interface Description:

The Web interface provides the same data collection function as the mobile application, but also provides added functionality in the form of detailed editing, reporting, and a reference library. The Web interface includes:

- a. A WE@CT Data Collection and Maintenance Interface. The Web site has the same survey tool checklists as the mobile application. This feature was developed to allow users who are unable to access PDAs (i.e., users in deployed environments), to input paper checklist data into the WE@CT data base and still benefit from the report writing capabilities.

b. Recommendation Editing Interface. The recommendation editing interface allows the user to make changes to recommendations that were generated by the WE@CT program. The user can delete, change or add recommendations as he or she sees fit based on the survey (Appendix B).

c. Reporting Interface. The reporting interface allows the user to input command, routing, distribution and signature information. The WE@CT program then compiles this information along with the survey information and produces a report in Adobe® Portable Document Format (PDF) that can be distributed (Appendix B). (Adobe® Systems Incorporated, San Jose, California.)

d. Reference Library Interface. The reference library interface allows the user to add to the report various appendices that pertain to the survey. The references are articles and fact sheets developed by the DOD Ergonomics Working Group (Appendix B).

4.0 Beta Test:

The Beta test portion of the project deployed the WE@CT to 10 DOD installations that have a history of work-related musculoskeletal injuries (DMED, 2004). The local industrial hygiene or safety office responsible for ergonomic evaluations at the installation will be given the WE@CT and instructed on how to use the computerized checklists and the reporting function. The users then use the WE@CT for up to 6 months to test the system.

a. Baseline Data. Each installation receiving the WE@CT was asked to submit data on the number of ergonomic assessments performed in the previous 6 months. Each user also estimated the amount of time required to collect the data, analyze the data, and produce a single report.

b. Mid-study Data. At the 3-month period, each user was asked to fill out a usability study (Lewis, 1995) based on his or her use of the WE@CT. The survey results were tabulated and used to address concerns the user had about the tool. A copy of the 3-month questionnaire is located in Appendix C.

The midpoint usability survey is divided into five areas of concentration: General Questions, PDA System Questions, Content Questions, Report/Recommendations, and Overall.

- General questions were used to determine the user's computer proficiency.
- PDA System Questions were used to determine the user's acceptance of the software design and layout.
- Content Questions were used to determine the value of each ergonomic checklist and the subsequent questions.
- Report/Recommendation questions were used to determine the value of the report section.
- The Overall section was used to address any areas that were not covered in the four previous survey areas.

c. Final Data. At the conclusion of the study, data on the number of reports produced by each of the 10 installations were collected from the central data base. The users of the WE@CT were asked to estimate the amount of time needed to collect the data, analyze the data, and produce a report. A copy of the final questionnaire is located in Appendix C.

The final usability survey used the same areas of concentration as the midpoint survey but added questions regarding the amount of time each survey required and the number of surveys completed.

d. Command Survey. The users' supervisor/command staff were asked to rate the quality and timeliness of ergonomic assessment reports prior to the WE@CT implementation and at the end of the project. A copy of the command survey is located in Appendix C.

e. Expert Users Survey. Although not part of the initial requirements of this project, a usability study of expert ergonomists was conducted. The four expert ergonomists were members of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHHPM) Ergonomics Program. Each expert user had several years of experience in the field of ergonomics and had completed several ergonomic evaluations each month. The expert users were given the same usability questionnaire as the installation users. The results were tabulated separately to keep the initial focus of the study intact. The expert usability surveys were used to validate the responses by the installation users and to provide more input to the developers during this initial development of the WE@CT.

KEY RESEARCH ACCOMPLISHMENTS

1.0 Beta Test:

Over 20 sites were initially contacted to take part in the initial beta test of the WE@CT. Ten sites (Anniston Army Depot, Alabama; Corpus Christi Army Depot, Texas; Watervliet Arsenal, New York; Fort Meade, Maryland; Fort Eustis, Virginia; Fort Detrick, Maryland; Aberdeen Proving Ground, Maryland; National Guard Maryland; National Guard Delaware; and National Guard Pennsylvania) with 11 users (Fort Eustis had two users) were chosen to participate.

A member of the WE@CT team was sent to each of the installations to set up and train the users on the WE@CT. The training consisted of an hour-long session complete with a users guide and synchronization steps. Upon completion of the training and installation, each user was left with the users guide, a PDA with the program, a user ID, a password, all supporting documentation, and points of contact information for technical questions. The users were left to evaluate and use the WE@CT during their normal operations.

2.0 Midpoint User Survey:

Each user was asked to evaluate the WE@CT and to attempt to use the tool when performing any ergonomic assessments within the next 6 months. Of the 11 users initially chosen to participate, 8 users remained in the study at the 3-month interval.

Though several attempts were made, Watervliet Arsenal, New York, was never able to use the Microsoft ActiveSync® connect to the WE@CT data base. Numerous individuals from the software developer to the local information management personnel were consulted, but the issue was never resolved. Anniston Army Depot's user dropped out of the study for personal reasons, and one of the Fort Eustis users left to take another position outside DOD.

The eight remaining users completed the midpoint usability survey and the results are as follows.

a. General Questions. Seven out of eight users rated themselves as having intermediate or expert computer skills. Six of those seven users said they had used a PDA before. One user rated his or her computer skills as "novice" and had no experience in using a PDA. The significance of this rating will be discussed later. (Note. Response key found in Appendix C.)

User	Skills	PDA Use
1	1	1
2	2	1
3	2	2
4	3	2
5	3	3
6	2	2
7	2	3
8	3	3

Table 1. Computer Skills

b. PDA System Questions. Twelve statements were used to evaluate the effectiveness of the PDA system. Each statement allowed the users six choices: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5), or Not Applicable (6). Strongly Disagree and Disagree were considered negative feedback while Agree and Strongly Agree were considered positive feedback.

The majority of the workers had positive feedback with regard to the PDA system. Five of the eight workers felt that the system was easy to use and easy to learn. Finally, six of the eight users were satisfied with the PDA system and the remaining two rated their satisfaction as “neutral.”

Of the 96 possible responses to the statements (12 statements/8 users), only 5 were negative. One user strongly disagreed that the system allowed users to effectively complete their work; two users disagreed that the system was quick to use. One worker disagreed that he/she became productive quickly with the system, and one worker disagreed that it was easy to correct mistakes.

User	Ease of Use	Simple Use	Effectively Complete Work	Quickly Work	Comfortable Using	Easy Learn	Quick Productive	Easy Correct Mistakes	Clear Org.	Pleasant Interface	Minimal User Interaction	Satisfied W/ System
1	3	3	3	3	3	3	3	3	3	4	4	3
2	5	5	3	4	5	5	5	4	4	5	4	5
3	4	3	4	3	4	3	3	3	4	4	4	4
4	5	5	1	5	5	5	5	5	5	5	5	5
5	3	3	3	2	3	3	2	6	6	3	3	3
6	5	5	5	5	5	5	4	4	4	4	4	5
7	5	5	5	1	5	5	5	1	5	5	5	5
8	5	5	5	5	5	5	5	4	4	4	4	4

Table 2. Midpoint System Questions

c. Content Questions. Five content statements were used to evaluate the content of the questions within the checklists. The same rating scheme was used as was with the PDA system questions.

All of the 30 possible responses to the content questions were either neutral or positive feedback. All of the users felt that the questions were easy to understand and followed a logical sequence. Three of the users responded with a neutral response when asked if “the evaluation questions had value.” Only one user responded with a neutral response that the questions were easy to understand and that they had difficulty performing required tasks such as computing measurement angles.

The content question section asked which checklists the users felt was the most and least useful. Also, the users were asked which checklists they used the most and the least. The General Ergonomics checklist was rated by half of the users as being the most useful and the most used, with the General Office checklist having three responses for both the most useful and the most used checklist. As rated by the users, the least useful and least used checklist was the Level 1 Administrative Task Analysis checklist.

User	Questions Easy to Understand	Questions Logical	Questions Valuable	Easily Understand	Perform Required Acts	Most Useful	Least Useful	Most Used	Least Used
1	4	4	3	4	3	1	5	1	5
2	5	5	5	5	5	2	6	2	3
3	4	4	3	4	4	5	6	5	1
4	5	4	4	4	4	1	7	1	7
5	4	4	3	3	6	1		1	7
6	4	5	4	4	4	1	7	1	7
7	5	5	5	5	5	2	7	2	7
8	4	4	4	4	4	2	8	2	3

Table 3. Midpoint Content Questions

d. Reports/Recommendations. Nine content statements were used to evaluate the report and recommendations within the checklists. The same rating scheme was used as was with the PDA system questions.

(1) Recommendations. Five questions dealt specifically with the recommendations issued by the WE@CT. Seven of the eight users felt that the recommendations that the WE@CT made were useful, appropriate and logical. The eighth user gave neutral feedback. Also, seven of the eight users felt that the recommendations given were neither too specific nor too general.

(2) Reports. Four thought the report layout was aesthetically pleasing, and a majority (five) felt that the report function saved time. However, several users gave a neutral or negative response to the ability to edit the report.

(3) Overall response. The overall section asked the question, "Did the PDA save time from the start of the evaluation to the final report?" Five users agreed that it saved time. One user responded with a neutral response, and two answered "not applicable."

The overall section asked the users to comment on what they liked about the WE@CT and to list what they would change about the tool. There was a wide range of answers to the question regarding what the users liked about the tool. However, statements such as easy to use or understand, the ability of the program to save time, and the fact that the program generates an automatic report appeared more than once. Regarding items that the users would change, the most popular responses addressed better connectivity/wireless capabilities and putting the reports in a more editable format.

User	Recom. Useful	Recom. Appropriate	Recom. Logical	Recom. Too Specific	Recom. Too General	Report Layout Logical	Report Aesthetically Pleasing	Edit Report Easily	Report Saved Time	Overall Saved Time
1	3	3	3	3	3	3	3	3	3	3
2	4	4	4	2	2	3	2	2	2	4
3	4	4	4	3	3	3	3	3	4	4
4	4	4	4	2	3	3	4	4	4	6
5	6	6	6	6	6	6	6	6	6	6
6	5	5	5	2	2	4	4	4	4	5
7	5	5	5	2	4	4	4	4	5	5
8	4	4	4	3	3	4	4	3	5	5

Table 4. Midpoint Recommendations/Reporting Questions

3.0 Final User Survey:

The eight users remaining from the midpoint usability survey were given the survey again approximately 6 months after the implementation of the WE@CT. Six additional questions were added; the questions pertained to the number of ergonomic surveys completed prior to and after the implementation of the WE@CT, the amount of time required to complete those surveys, and the amount of time required to complete the associated report. A copy of this survey is in Appendix C.

Six of the eight users returned the final survey. Of the two users who did not return the survey, one contacted the researcher claiming technical issues with the PDA device. The researcher attempted to contact the other user several times, but was unsuccessful.

Of the six users who returned the survey, one user answered only two questions from the survey and made a comment that he/she did not use the device between the midpoint and final usability questionnaire. Therefore, five users provided input for the final usability questionnaire.

a. Number of Surveys Completed. In the 6 months prior to implementation of the WE@CT, the users said that as many as seven ergonomic surveys had been completed at their bases to as few as two. The amount of time to complete these surveys ranged from as much as 8 hours to as little as 45 minutes to complete the survey portion and as much as 4 hours to as little as 1 hour to complete the written report.

After the WE@CT was implemented, as many as 10 surveys were completed by one user and 0 surveys by another user. The time required to conduct a survey using the WE@CT ranged from 15 minutes to 3 hours. Report writing ranged from 20 minutes to 2 hours using the WE@CT.

The amount of time to complete the surveys and reports before and after implementation were averaged.

	Before WE@CT	After WE@CT
Survey time	3.05	1.19*
Report time	2.2	1.21*
Total time	5.25	2.4*

Table 5. Time Requirements to Complete Survey

*Only 4 responses

According to the information provided, the average amount of time to complete both the survey and report functions after implementation of the WE@CT program was less than one-half the prior completion time.

b. PDA System Questions. Again, 12 statements were used to evaluate the effectiveness of the PDA system. Each statement allowed the users six choices: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5) or Not Applicable (6). Strongly Disagree and Disagree were considered negative feedback while Agree and Strongly Agree were considered positive feedback.

User	Ease of Use	Simple Use	Effectively Complete Work	Quickly Work	Comfortable Using	Easy Learn	Quick Productive	Easy Correct Mistakes	Clear Org.	Pleasant Interface	Minimal User Interaction	Satisfied W/ System
1					Did not respond							
2	5	5	4	4	5	5	5	5	5	5	5	5
3	4	4	4	4	4	4	3	3	3	4	4	4
4	5	5	5	6	5	5	5	5	5	4	4	5
5					Did not respond							
6	5	5	5	5	5	5	5	4	4	4	4	5
7					Did not respond							
8	5	5	5	5	5	5	5	4	4	4	4	4

Table 6. Final System Questions

Of the 60 possible responses to the statements (12 statements/5 users), there were no negative responses. One user responded with neutral feedback to comments that he/she became productive quickly using the system, that mistakes were easy to correct, and that the information on the screen was clear. All other users gave positive responses to each of the PDA system questions.

c. Content Questions. Five content statements were used to evaluate the content of the questions within the checklists. The same rating scheme was used as was with the PDA system questions.

Again, all of the 30 possible responses to the content questions were either neutral or positive feedback. All of the users felt that the questions were easy to understand and followed a logical sequence. Previously, three of the users gave a neutral response when asked if “the evaluation questions had value.” This time, only one user had a neutral response.

The content question section also asked which checklists the users felt was the most and least useful. Also, the users were asked which checklists they used the most and the least. At this stage of the usability study, two users felt the General Office checklist was the most useful. One user felt the General Ergonomics checklist was the most useful, and one felt the VDT Assessment checklist was the most useful. The VDT, Washington State-Caution Zone, Washington State-Hazard Zone, and the Level 1 Administrative Task Analysis checklists all received one response as the least useful checklist. The Washington State-Hazard Zone checklist also received the most responses as the least used checklist.

User	Questions Easy Understand	Questions Logical	Questions Valuable	Easily Understand	Perform Required acts	Most Useful	Least Useful	Most Used	Least Used
1		Did not respond							
2	4	4	4	4	4	2	6	2	7
3	4	4	3	4	4	5	7	5	7
4	4	5	5	5	4				
5		Did not respond							
6	4	4	4	5	4	1	5	1	7
7		Did not respond							
8	4	4	4	4	4	2	8	2	3

Table 7. Final Content Questions

d. Reports/Recommendations. Nine content statements were used to evaluate the report and recommendations within the checklists. The same rating scheme was used as was with the PDA system questions.

(1) Recommendations. Five questions dealt specifically with the recommendations issued by the WE@CT. All five of the users felt that the recommendations the users made were useful, appropriate and logical. One user felt that the recommendations issued by the WE@CT were too general.

(2) Reports. The majority of the users gave positive feedback as to the logical layout of the report. Four thought the report layout was aesthetically pleasing and a majority (three) felt that the report function saved time. However, several users gave the ability to edit the report a neutral or negative response.

(3) Overall response. The overall section asked the question, "Did the PDA save time from the start of the evaluation to the final report?" Three users agreed that it saved time. One user responded with a neutral response, and one did not answer.

The overall section asked the users to comment on what they liked about the WE@CT and to list what they would change about the WE@CT. Again, like the 3-month usability study, there was a wide range of answers to the question regarding what the users liked about the tool. However, statements such as easy to use or understand, the ability of the program to save time, and the fact that the program generates an automatic report appeared more than once. Regarding items that the users would change, the most popular responses addressed better connectivity and easier report editing capabilities. Also added were comments pertaining to resolution of some of the synchronization issues.

User	Recom. Useful	Recom. Appropriate	Recom. Logical	Recom. Too Specific	Recom. Too General	Report Layout Logical	Report Aesthetically Pleasing	Edit Report Easily	Report Saved Time	Overall Saved Time
1			Did not respond							
2	4	4	4	3	3	4	2	1	2	3
3	4	4	4	3	4	3	4	4	5	5
4	5	4	5	2	2	4	4	4		
5			Did not respond							
6	4	4	4	2	2	4	4	4	5	5
7			Did not respond							
8	4	4	4	3	3	4	4	3	5	5

Table 8. Final Recommendations/Reporting Questions

4.0 Commander/Supervisor Survey:

The supervisors of the eight users remaining from the midpoint usability survey were given the survey to complete at the same time the users were given their final usability questionnaire. The survey asked supervisors to compare productivity, quality, and customer service based on the implementation of the WE@CT. A copy of the supervisor survey is in Appendix C.

Five of the eight supervisors who were sent the survey returned it. Numerous attempts were made to have the other three surveys returned without results. Two of the five returned the survey with only a few of the 10 questions filled out. Therefore, results are based on the three completed surveys.

a. Survey Time. All three supervisors claimed that surveys prior to the WE@CT required 1 to 2 man hours. With the implementation of WE@CT, two of the supervisors claimed that it now takes their employees less than an hour to complete a survey.

b. Report Time. The amount of time needed to write a report before and after WE@CT implementation received mixed results. One supervisor claimed it required the same amount of time (1 to 2 hours). One supervisor claimed it required more time to use WE@CT to write a report. The third supervisor claimed it required less time.

c. Quality of reports. The quality of the reports received mixed results as well. One supervisor was neutral on whether the quality of reports was improved by using WE@CT; one claimed it was not improved; and the third claimed the quality was improved.

(1) Usefulness of recommendations. Two of the supervisors provided neutral responses to the statement that the recommendations generated by the WE@CT were more useful than recommendations previously given. The third supervisor felt that the WE@CT-generated recommendations were more useful.

(2) Improved customer service. Two of the supervisors felt that the WE@CT did improve customer service while the third had a neutral response.

d. Changes and General Comments. Each supervisor was given a chance to comment on the WE@CT. The comments reflected the comments of the users. The supervisors noted that the WE@CT seemed easy to use and easy to get results from, but supervisors also echoed the users' opinion that the report function needed to be addressed in order to make it more user friendly.

Supervisor	No. of Surveys Prior	Survey Time Prior	Report Time Prior	WE@CT Survey Time	WE@CT Report Time	Improved Report Quality	Useful Recommendations	Improved Customer Support
1	2	2	1	1	1	4	3	4
2	4	2	1	2	2	2	4	4
3	1	5			N/A	N/A	N/A	N/A
4	6	2	2	1	1	3	3	3
5	4	2	1	1	N/A	N/A	N/A	N/A

Table 9. Supervisor Survey

5.0 Expert User Survey:

Four expert ergonomists completed the usability study 6 months after the implementation of the WE@CT. The usability survey was the same survey given to the installation users at the after 6 months in the study.

a. Number of Surveys Completed. In the 6 months prior to the implementation of the WE@CT, the expert users said that as many as 10 ergonomic surveys had been completed at their bases to as few as one. The amount of time to complete these surveys ranged from as much as 2 hours to as little as 24 minutes to complete the survey portion and as much as 5 hours to as little as 30 minutes to complete the written report.

After the WE@CT was implemented, as many as 40 surveys were completed by one user and 6 surveys by another user. The time required to conduct a survey using the WE@CT ranged from 10 minutes to 15 minutes. Report writing ranged from 10 minutes to 2 hours using the WE@CT. The table below shows the average amount of time to complete the surveys and reports before and after WE@CT implementation.

	Before WE@CT	After WE@CT
Survey time	51 min	32 min
Report time	3 hrs	1 hr 23 min
Total time	3hrs 51 min	1 hr 55 min

Table 10. Expert time requirements to complete survey

According to the information provided, the average amount of time to complete both the survey and report functions after implementation of the WE@CT program was about one-half the prior completion time.

b. PDA System Questions. Again, 12 statements were used to evaluate the effectiveness of the PDA system. Each statement allowed the users six choices: Strongly Disagree (1) Disagree (2), Neutral (3), Agree (4), Strongly Agree (5) or Not Applicable (6). Strongly Disagree and Disagree were considered negative feedback while Agree and Strongly Agree were considered positive feedback.

Expert User	Ease of Use	Simple Use	Effectively Complete Work	Quickly Work	Comfortable Using	Easy Learn	Quick Productive	Easy Correct Mistakes	Clear Org.	Pleasant Interface	Minimal User Interaction	Satisfied W/ System
1	4	4	4	4	4	4	3	3	3	4	4	4
2	4	4	4	4	4	4	4	3	4	3	4	4
3	4	4	4	4	5	5	5	4	4	4	4	4
4	4	4	3	4	4	4	4	4	4	4	3	4

Table 11. Expert Ergonomist User System Questions

Of the 48 possible responses to the statements (12 statements/4 users), there were no negative responses. Two expert ergonomists gave neutral responses to the question regarding the “ease of correcting mistakes.” The questions pertaining to “effectively completing work,” “quick productivity,” “clear organization,” and “pleasant interface” all received one neutral response.

c. Content Questions. Five content statements were used to evaluate the content of the questions within the checklists. The same rating scheme was used as was with the PDA system questions.

All of the 20 possible responses to the content questions were either neutral or positive feedback. All of the expert ergonomists felt that the questions were easy to understand and followed a logical sequence. One expert ergonomist had a neutral response to statements regarding the value of each question and the ease of performing required acts, such as angle measurements and force calculations.

The content question section also asked which checklists the expert ergonomists felt were the most and least useful. Also, the expert ergonomists were asked which checklists they used the most and the least. At this stage of the usability study, two expert ergonomists felt the General Office checklist was the most useful. One expert ergonomist felt the General Ergonomics

checklist was the most useful, and one felt the VDT Assessment checklist was the most useful. These are the same results as the installation users' final usability survey. The Material Handling and the Level 1 Industrial Task Analysis checklists received one response each while the Washington State-Caution Zone checklist received two responses as the least useful checklist. The Washington State-Hazard Zone checklist also received the most responses as the least used checklist.

Expert User	Questions Easy Understand	Questions Logical	Questions Valuable	Easily Understand	Perform Required acts	Most Useful	Least Useful	Most Used	Least Used
1	4	4	3	4	3	5	9	5	9
2	4	4	4	4	4	1	6	1	6
3	4	4	4	4	5	2	3	2	3
4	4	4	4	4	4	2	6	2	6

Table 12. Expert Ergonomist Content Questions

d. Reports/Recommendations. Nine content statements were used to evaluate the report and recommendations within the checklists. The same rating scheme was used as was with the PDA system questions.

(1) Recommendations. Five questions dealt specifically with the recommendations issued by the WE@CT. All four of the expert ergonomists felt that the recommendations that the users made were useful, appropriate and logical. Two of the users felt that the recommendations issued by the WE@CT were too general.

(2) Reports. All of the expert ergonomists gave positive feedback as to the logical layout of the report. They thought the report layout was aesthetically pleasing. However, one expert ergonomist gave the ability to edit the report a negative response, indicating that the report was difficult to edit.

(3) Overall response. The overall section asked the question, "Did the PDA save time from the start of the evaluation to the final report?" All four ergonomic experts agreed that it saved time.

The overall section asked the users to comment on what they liked about the WE@CT and to list what they would change about the WE@CT. There was a wide range of answers to the question regarding what the users liked about the tool. However, statements such as easy to use or understand, the ability of the program to save time, and the fact that the program generates an automatic report appeared more than once.

Regarding items that the expert ergonomists would change, "easier report editing capabilities" was the predominate recommendation. Also added were comments pertaining to the ability to take photographs and "to make the checklists editable by the users."

FY04 AMEDD TELEHEALTH INITIATIVE FINAL REPORT

User	Recom. Useful	Recom. Appropriate	Recom. Logical	Recom. Too Specific	Recom. Too General	Report Layout Logical	Report Aesthetically Pleasing	Edit Report Easy	Report Saved Time	Overall Saved Time
1	4	5	5	3	3	4	4	2	3	4
2	4	4	4	2	4	4	4	4	4	4
3	4	4	4	3	4	4	4	6	6	6
4	4	4	4	3	3	4	4	4	4	4

Table 13. Expert Ergonomist Recommendations/Reporting Questions

REPORTABLE OUTCOMES

1.0 Goal:

The goal of this initiative was to begin the development of a computer-based software tool that would allow users to carry out the survey and report writing functions of an ergonomic assessment. As of March 2005, the WE@CT's mobile portion has been used at nine installations. The Web-based data base and reporting function has been running on a test server since May 2005.

The goal of the beta test was to take the system out to the end users and have the users provide valuable feedback about the system rather than develop the system in a vacuum. The developers, using a beta test, were able to see what functions of the system work, what functions do not work, what users like, and what users do not like. Also, the beta test provided an opportunity for the developers to look at market conditions and see if there is, in fact, a demand for the product being developed.

Although the number of participants in the beta test was limited, a great deal of valuable information was garnered that will allow a better product to be developed along with a more comprehensive plan to implement the WE@CT in an efficient and fiscally responsible manner.

2.0 WE@CT Development:

The WE@CT development process was a time-consuming process. Each of the 10 checklists had to be reworded to fit the software scheme being used. At the same time, most of the checklists did not provide recommendations. Recommendations for each checklist statement had to be researched, and each recommendation had to be tied to a specific reference from a literature source. However, the time spent during the development phase has delivered a product that can produce repeatable and accurate assessments.

3.0 Usability Study:

3.1 System Questions:

Although the feedback from the usability studies was less than anticipated, the information provided by the users has enabled the developers of the WE@CT to make necessary changes to the program. This also provides a clear direction to proceed with implementation of the tool.

Based on the feedback from the PDA system questions, it can be inferred that the majority of the users felt comfortable with the layout of the program and felt that it was quick and easy to work with. The individual who found that the system was difficult to use had rated himself/herself a novice computer user.

The information derived from the PDA system feedback shows that those people who are comfortable with computers and computer devices should have little difficulty using the WE@CT's survey function. However, those who have little computer skills may need extensive training on how the program works and functions. This information will allow us to better develop the training tools that will accompany the implementation of the WE@CT program.

The system questions answered by the installation users were compared to those of the expert ergonomists. The results showed that there was agreement between the two user groups. Both the installation users and the expert ergonomists were overwhelmingly positive when ease and simplicity of use were questioned. Both sets of users felt comfortable using the system, and they were, overall, satisfied with the system. However, ease of correcting mistakes and how quick the user became productive scored lower with the installation users than with the expert ergonomists. This stands to reason because the expert ergonomists used the program much more often than did their installation counterparts.

3.2 Content Questions:

The most used checklists were those that are associated with traditional ergonomics. The General Ergonomics, General Office and VDT Assessment checklists all deal with the traditional areas of computer use. The other checklists that are used in industrial environments were either not used or were determined to be not useful. These ratings did not come as a surprise to the developers. Most ergonomic programs in their infancy tend to focus on office assessments and computer use.

Using this information, the developers will likely move the VDT checklist higher on the menu to make it easier for users to find and use this checklist. Also, as changes to the checklists are made in the future, the developer will use this information to prioritize the order in which changes are made.

Most of the users felt that the recommendations given were useful, appropriate and logical. One user felt that the recommendations issued were too general. This issue will be handled during training. The training now emphasizes that the recommendations that are being made are "starting points" and that the evaluator has the ability to add specific recommendations for each statement. Training will also focus on how to and where to make the changes and implement the recommendations both on the mobile PDA or via the Web-based report function.

3.3 Report Function:

The report function had the most negative responses from both the users and the supervisors. Initially the report was generated in a PDF format. The users needed to have the Adobe[®] Acrobat[®] (Adobe[®] Systems Incorporated, San Jose, California) program in order to make changes to the report once it had been generated by the WE@CT. Most organizations do not have the level of the Adobe[®] Acrobat[®] program needed to make these edits. It is this researcher's opinion that this may have contributed to the low number of actual reports generated by the WE@CT during the beta test. Because of the overwhelming response to the number of people who asked for the ability to edit the reports, a TIFF[™] (Adobe[®] Systems Incorporated, San Jose, California) format for the report was developed. Using the TIFF[®] format, the users were able to copy and paste the report into a Word[®] (Microsoft Corporation, Redmond, Washington) document and complete their edits.

The introduction of the TIFF[®] format option satisfied some of the more experienced users; however, for those who were novice computer users, the development of the reports to feed directly into Word[®] is of utmost importance to the acceptance of this program as a useful survey tool.

3.4 Cost Benefit:

The initial response of the users was that the tool will save time when they perform an ergonomics survey. This was evident by the reduction in time to complete a survey and write a report as shown by the second usability survey.

However, there are many caveats to this statement. The users need to be proficient in computers and the WE@CT. They need proper training in the WE@CT, and they need to consistently use the WE@CT when conducting a survey. Using a software program once every 4 months is not going to provide any cost benefit because of the diminished familiarity with the program that occurs over time.

3.5 Expert Ergonomist Surveys:

The expert ergonomist surveys reinforced the need to use the WE@CT to become more proficient. The expert ergonomists significantly reduced both their evaluation time and their report writing time.

Because the expert ergonomists had more opportunities to use the reporting function, they were able to master the merging of the WE@CT document into a Word[®] file. This ability allowed the expert ergonomists to edit their reports. However, the responses to the usability content and report statements echo the responses given by the installation users. The need to have a more seamless report writing function is of the utmost importance, and the developers need to address this.

The addition of the expert ergonomist usability study allowed a more robust testing of the WE@CT. The addition of the 4 users and 78 surveys tested the system's capabilities along with the report writing function. Although the expert ergonomists were not part of the original requirements, it was a worthwhile experience.

CONCLUSIONS

This researcher and his colleagues have taught ergonomics classes at more than 50 installations over the past 10 years. One common theme echoed by class participants at these installations is that there is very little time for ergonomic surveys to be performed because of the many other responsibilities of the individuals. Although DOD Instruction 6055.1 establishes program requirements for installation ergonomics programs, ergonomics is often thought of as collateral duty. Without full-time ergonomists on staff at installations, it is often the responsibility of industrial hygiene and safety professionals to perform the ergonomics function when time permits.

This continuous theme spearheaded the development of the WE@CT program. It was thought that the development of a program that made it easy for users to perform ergonomic surveys would help promote the need for ergonomics.

The beta test showed that the tool developed is a good first step in the development of an ergonomic checklist tool. The beta test users responded that the tool met many of the requirements needed for an ergonomic survey checklist, and that, with a little practice and effort, the majority of users could become proficient with the system. This proficiency will allow users to maximize their time spent on ergonomics.

The beta test also revealed that the reporting function of the WE@CT needs to be further developed. The tool needs to be seamlessly integrated into a word processing software in order to allow the users to further edit their reports to meet local requirements.

Finally, the WE@CT is a tool. It is to be used by industrial hygiene and safety professionals when they are required to provide an ergonomic assessment of a workstation. The use and acceptability of the tool goes beyond simply providing a PDA and some instructions on how to use it. The WE@CT needs to be part of a comprehensive ergonomics program that addresses the needs of individual installations. The WE@CT itself is not an ergonomics program as anecdotal information gathered during the survey proved. When WE@CT was used by individuals who have had training in ergonomics and have an active ergonomics program, the tool proved to be a benefit. To those who had little ergonomics experience or did not have a well-established ergonomics program, it was met with resistance as evidenced by the number of surveys returned by supervisors and the lack of response of some of the users.

When moving forward with the implementation of the WE@CT, careful consideration should be given to which installations receive the program. A blanket issuing of WE@CT to all installations would result in a waste of resources. Those installations that have an active ergonomics program and have users who are familiar with PDAs should be targeted. This approach will allow the WE@CT program to be successfully implemented in a select number of locations. This in turn will provide more lessons learned and allow for implementation at other installations in the future.

APPENDIX A: TECHNICAL SUMMARY

Software:

PDA Component:

Software: Microsoft® Windows® Visual Studio.NET™

Compact Framework: Microsoft® Windows® Visual Basic.NET™

Operating System: Microsoft® Windows® Mobile®

Web site Component:

Software: Microsoft® Windows® Active Server Pages (ASP).NET™

Framework: Microsoft® Windows® Visual Studio.NET™

Reporting Function:

Software (Development): Microsoft® Windows® ASP.NET™

User: Adobe® Acrobat® Reader

Synchronization:

Software: Microsoft® ActiveSync®

Hardware:

PDA(s): Dell™ Axim X5 Pocket PC (Dell, Inc., Round Rock, Texas)

The WE@CT consists of a mobile data collection application and a Web-based application for data entry, manipulation, analysis, and reporting. The mobile data collection component is developed in Microsoft® Windows® Visual Studio.NET™ and submits data to a central Microsoft® SQL Server 2000 data base. The Web-based component is comprised of ASPs and is capable of interfacing with the central data base for the purposes described.

APPENDIX B: FUNDED PERSONNEL AND PARTICIPANTS

Funded Personnel

Name:	Hours to date:
Mr. Steven Chervak, GS-13	350.00
Mr. John Pentikis, GS-13	30.00
Mr. Clark Dutterer, Professional Associate	45.00
Mr. Jonathan Drum, Professional Associate	3.00

APPENDIX C: SUPPORTING DOCUMENTATION**Midpoint Usability Survey**

PDA USABILITY QUESTIONNAIRE Number 1

General Questions (Highlight Your Answer)						
I would rate my computer skills as:	Novice (1)	Intermediate (2)	Expert (3)			
I have used a Personal Digital Assistant (PDA):	Never (1)	A few times (2)	Frequent (3)			
The other PDAs I have used have used:	Palm OS (1)	Windows OS (2)	Don't know (3)	N/A (4)		
PDA System Questions						
(Place an X in the Appropriate Box)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	N/A (6)
Overall, I am satisfied with how easy it is to use this system						
It was simple to use this system						
I can effectively complete my work using this system						
I am able to complete my work quickly using this system						
I feel comfortable using this system						
It was easy to learn to use this system						
I believe I became productive quickly using this system						
When I make a mistake using the system, I recover easily and quickly						
The organization of information on the screens is clear						
The interface of the system is pleasant						
The system require minimal user control actions						
Overall, I am satisfied with the system						
Content Questions						
(Place an X in the Appropriate Box)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	N/A (6)
The evaluation questions were easy to understand						
The evaluation questions follow a logical sequence						
The evaluation questions had value						
I could easily understand the evaluation questions						
I could perform the requirements of the question (i.e. measuring, force requirements, angle assessments)						
What section did you find the most useful (Highlight Choice)	General Ergo (1) Wash St. Caution (6)	General Office (2) Wash State Hazard (7)	Material Handle (3) Level 1 Admin (8)	Hand Tools (4) Level 1 Industrial (9)	VDI (5)	
What section did you find the least useful (Highlight Choice)	General Ergo (1) Wash St. Caution (6)	General Office (2) Wash State Hazard (7)	Material Handle (3) Level 1 Admin (8)	Hand Tools (4) Level 1 Industrial (9)	VDI (5)	
What section did you use the most (Highlight Choice)	General Ergo (1) Wash St. Caution (6)	General Office (2) Wash State Hazard (7)	Material Handle (3) Level 1 Admin (8)	Hand Tools (4) Level 1 Industrial (9)	VDI (5)	
What section did you use the least (Highlight Choice)	General Ergo (1) Wash St. Caution (6)	General Office (2) Wash State Hazard (7)	Material Handle (3) Level 1 Admin (8)	Hand Tools (4) Level 1 Industrial (9)	VDI (5)	
Report/Recommendations						
(Place an X in the Appropriate Box)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	N/A (6)
The recommendations were useful						
The recommendations were appropriate						
The recommendations were logical						
The recommendations were too specific						
The recommendations were too general						
The layout of the report was logical						
The layout of the report was aesthetically pleasing						
Editing the report was easy						
The reporting function saved me time writing the report						
Overall						
(Place an X in the Appropriate Box)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	N/A (6)
The PDA saved time from the start of the evaluation to final report						
List three things you liked about the Ergo PDA	1	2	3			
List three things you would change about the Ergo PDA	1	2	3			

Final Usability Survey

PDA USABILITY QUESTIONNAIRE Number 2

Answer the following questions with regards to surveys done prior to WE@CT:

In the 6 months Prior to you receiving the PDA Tool, how many ergonomics surveys did you complete?

Answer:

How long did it take you to complete the survey

Number

How long did it take you to write the associated report

hrs

Answer the following questions with regards to WE@CT

How many WE@CT surveys did you complete

Number

How long did it take you to complete the survey

hrs

How long did it take you to write the associated report

hrs

General Questions (Highlight Your Answer)

I would rate my computer skills as:

Novice (1)

Intermediate (2)

Expert (3)

I have used a Personal Digital Assistant (PDA):

Never (1)

A few times (2)

Frequent (3)

The other PDAs I have used have used:

Palm OS (1)

Windows OS (2)

Don't know (3)

N/A (4)

PDA System Questions

(Place an X in the Appropriate Box)

Strongly

Disagree

Neutral

Agree

Strongly

N/A

Overall, I am satisfied with how easy it is to use this system

Disagree (1)

(2)

(3)

(4)

Agree (6)

(6)

It was simple to use this system

I can effectively complete my work using this system

I am able to complete my work quickly using this system

I feel comfortable using this system

It was easy to learn to use this system

I believe I became productive quickly using this system

When I make a mistake using the system, I recover easily and quickly

The organization of information on the screens is clear

The interface of the system is pleasant

The system require minimal user control actions

Overall, I am satisfied with the system

Content Questions

(Place an X in the Appropriate Box)

Strongly

Disagree

Neutral

Agree

Strongly

N/A

The evaluation questions were easy to understand

Disagree (1)

(2)

(3)

(4)

Agree (5)

(6)

The evaluation questions follow a logical sequence

The evaluation questions had value

I could easily understand the evaluation questions

I could perform the requirements of the question

(i.e. measuring, force requirements, angle assessments)

What section did you find the most useful (Highlight Choice)

General Ergo (1)

General Office (2)

Material Handle (3)

Hand Tools (4)

VDT (5)

Wash St. Caution (6)

Wash State Hazard (7)

Level 1 Admin (8)

Level 1 Industrial (9)

What section did you find the least useful (Highlight Choice)

General Ergo (1)

General Office (2)

Material Handle (3)

Hand Tools (4)

VDT (5)

Wash St. Caution (6)

Wash State Hazard (7)

Level 1 Admin (8)

Level 1 Industrial (9)

What section did you use the most (Highlight Choice)

General Ergo (1)

General Office (2)

Material Handle (3)

Hand Tools (4)

VDT (5)

Wash St. Caution (6)

Wash State Hazard (7)

Level 1 Admin (8)

Level 1 Industrial (9)

What section did you use the least (Highlight Choice)

General Ergo (1)

General Office (2)

Material Handle (3)

Hand Tools (4)

VDT (5)

Wash St. Caution (6)

Wash State Hazard (7)

Level 1 Admin (8)

Level 1 Industrial (9)

Report/Recommendations

(Place an X in the Appropriate Box)

Strongly

Disagree

Neutral

Agree

Strongly

N/A

The recommendations were useful

Disagree (1)

(2)

(3)

(4)

Agree (5)

(6)

The recommendations were appropriate

The recommendations were logical

The recommendations were too specific

The recommendations were too general

The layout of the report was logical

The layout of the report was aesthetically pleasing

Editing the report was easy

The reporting function saved me time writing the report

Overall

(Place an X in the Appropriate Box)

Strongly

Disagree

Neutral

Agree

Strongly

N/A

The PDA saved time from the start of the evaluation to final report

Disagree (1)

(2)

(3)

(4)

Agree (5)

(6)

List three things you liked about the Ergo PDA

1

2

3

List three things you did not like about the Ergo PDA

1

2

3

List three things you would change about the Ergo PDA

1

2

3

Supervisor Survey

WE@CT Beta Test Questionnaire for Supervisors

1) In an average 6-month period, how many ergonomic surveys does your group do?

0 (1) 1-2 (2) 3-4 (3) 5 or more (4)

Please answer the following questions based on surveys and reports done **prior** to your employee receiving the WE@CT ergonomic survey PDA tool.

2) Approximately how long did it take your employee to complete an ergonomic survey (just the survey portion)?

Less than 1 hr (1) 1-2 hrs (2) 3-4 hrs (3) More than 4 hrs (4) N/A (5)

3) Approximately how long did it take your employee to write up the report portion of the survey?

1-2 hrs (1) Half day (2) Full day (3) Many days (4) Reports not required (5)

Please answer the following questions based on surveys and reports done **while using** the WE@CT ergonomic survey PDA tool.

4) Approximately how long did it take your employee to complete an ergonomic survey (just the survey portion)?

Less than 1 hr (1) 1-2 hrs (2) 3-4 hrs (3) More than 4 hrs (4) Surveys were not generated (5)

5) Approximately how long did it take your employee to write up the report portion of the survey?

1-2 hrs (1) Half day (2) Full day (3) Days (4) Reports were not generated (5)

Please compare the survey reports generated before and after deployment of the WE@CT Ergonomics PDA.

6) The reports generated by the WE@CT ergonomics survey PDA tool are of a better quality than previous reports.

Strongly Disagree (1) Disagree (2) Neutral (3) Agree (4) Strongly Agree (5) N/A (6)

7) The reports generated by the WE@CT ergonomics survey PDA tool contain more useful recommendations than previous surveys.

Strongly Disagree (1) Disagree (2) Neutral (3) Agree (4) Strongly Agree (5) N/A (6)

8) Using the WE@CT ergonomics survey PDA tool allowed us to more quickly attend to the needs of our customers by providing a more timely and detailed survey report.

Strongly Disagree (1) Disagree (2) Neutral (3) Agree (4) Strongly Agree (5) N/A (6)

What changes would you like to see made to the WE@CT ergonomic survey PDA tool?

Comments:

General Comments?

APPENDIX D: PRESENTATIONS, POSTERS, PUBLICATIONS

01-04 September 2004 Broucha Ergonomics Conference, Keystone, CO
“Web Based Ergonomic Assessment Tool”

APPENDIX E:

WE@CT Screen Shots

Recommendation Screen

The screenshot shows a window titled "Pocket_PC2" with a menu bar (File, Zoom, Tools, Help) and a status bar (Finding Edit, 10:00, ok). The main content area is divided into three sections: "Finding:" with the text "Tool weight between 5 - 25 lbs.", "*Recommendation:" with the text "Provide tool support device or proper arm support; reduce tool use / holding time.", and "Comments:" with the text "There are lighter weight tools that can be purchased". Below the text areas is a virtual keyboard with a numeric keypad, letters, and function keys.

Synchronization Screen

The screenshot shows a window titled "Pocket_PC" with a menu bar (File, Zoom, Tools, Help) and a status bar (Login, 2:05, ok). The main content area contains a "User ID:" label next to a text input field containing the letter 'e', a "Password:" label next to an empty text input field, and a "Log In" button. Below the input fields is a virtual keyboard with a numeric keypad, letters, and function keys.

WE@CT WEB Editing Screen

Finding Details

Finding
The seat height is not adjustable so that the worker's feet are flat on the floor (or on a footrest) and the lower back is supported.

Recommendation
Provide adjustable chair, change the workstation height or provide a footrest.

Comments
Supervisor indicated that there are sufficient funds for purchasing a new chair

Cancel Save

Security & Privacy | Hyperlink Policy | Contact USACHPPM

WE@CT WEB Report Screen

Report Details

'Memorandum Thru: Director, Occupational Health Sciences

'Prepared For: Ambrose Hill

'Subject: Ergonomic Assessment of Building 1007 Office Personnel

'Purpose: To determine causes of current employee injuries and potential causes of possible future injuries.

'Signature Block: Pierre Beauregard
Ergonomist
USACHPPM

'Point of Contact Name: Pierre Beauregard

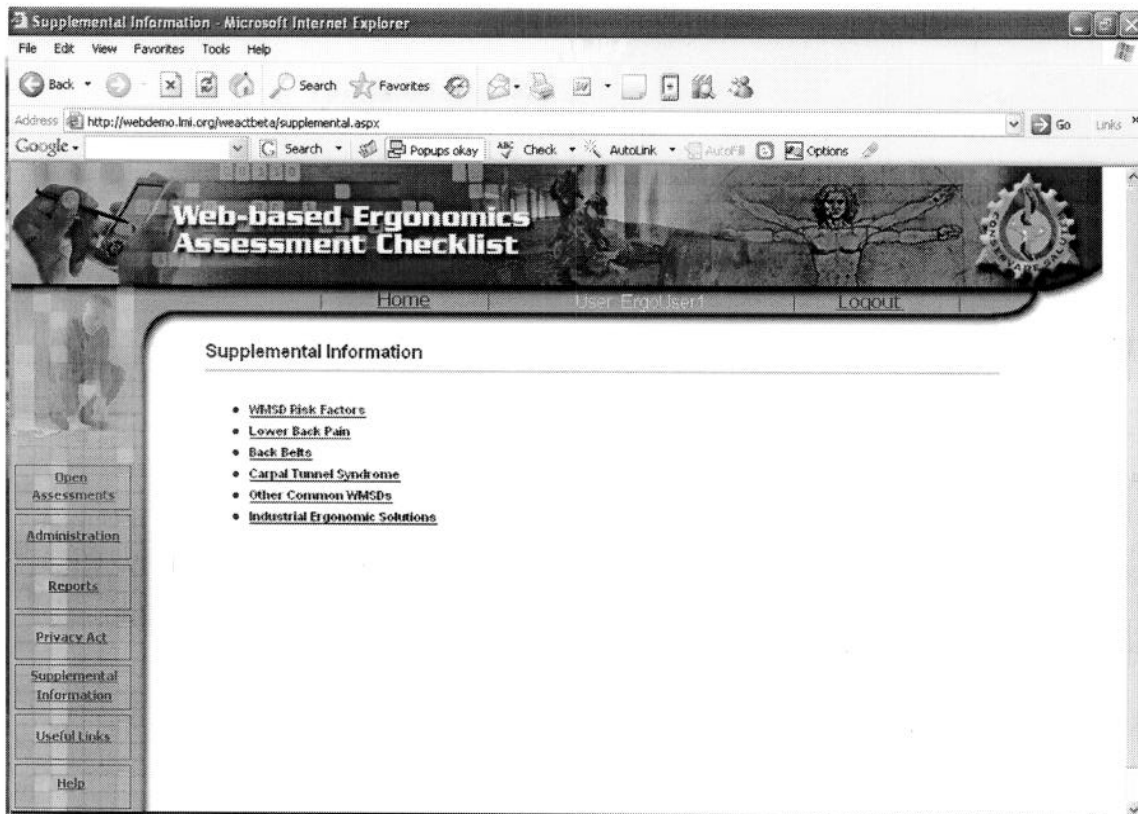
'Point of Contact Email: pgtbeauregard@cs.army.mil

Include Appendices: ☐

Cancel Print Preview

Done Internet

WE@CT Reference Library Screen



APPENDIX F:

References

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